

6.034 Recitation 6: Constraint Satisfaction Problem (10/21/05)

LOrtiz (Orig. by KKoile)

Let's look at a train scheduling problem similar to the scheduling problem mentioned in lecture.

There are 4 trains (T1 T2 T3 T4) and three locomotives.(L1 L2 L3). What assignments of locomotives to trains will satisfy the following schedule:

<u>Train</u>	<u>in use</u>
T1	8am to 10am
T2	9am to 1pm
T3	noon to 2pm
T4	11am to 3pm

Make the following assumptions:

Each locomotive can only pull one train at a time.

Each locomotive has time to get to the station where its next train is located.

L3 is too small to pull T3.

L2 and L3 are too small to pull T4.

1. Draw timelines representing when each train is in use, and show constraints by drawing arrows between timelines representing trains that cannot use the same locomotive.

T1

T2

T3

T4

2. What are the variables?

What are the values?

What are the possible values for each variable?

Now reverse your choice of variables and values. What would the possible values be for those variables?

3. Draw the constraint diagram for this problem, labeling each node with the variable it represents and the domain for that variable. What do the links represent?

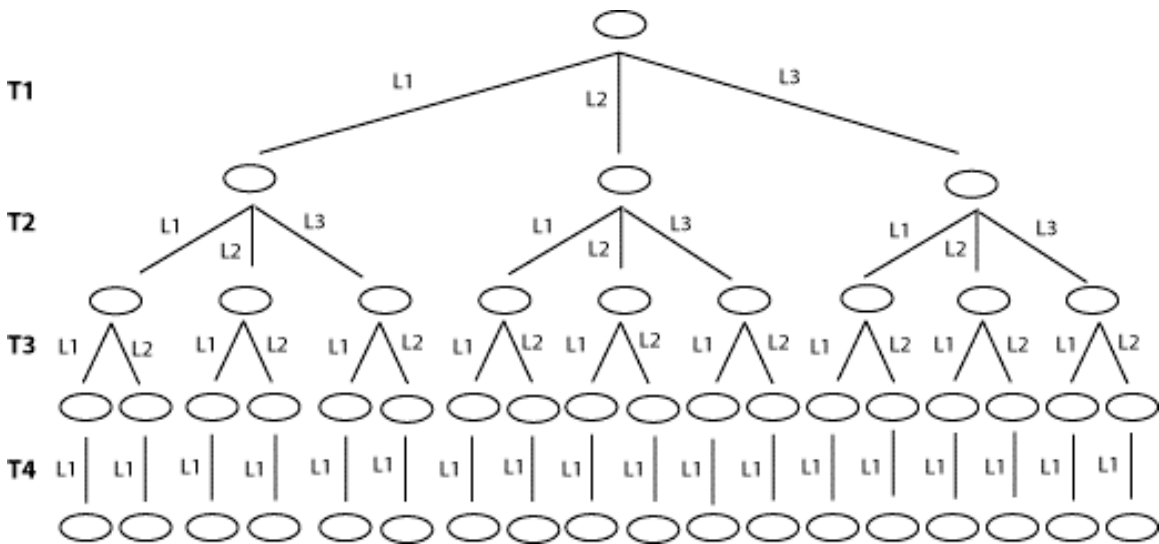
4. Try finding a solution to this problem using only constraint propagation. Finish filling in the table below (as in the online recitation notes). Are the arcs consistent at the end of the propagation procedure? Why is constraint propagation in general not sufficient to solve constraint satisfaction problems?

<u>arc</u>	<u>value deleted</u>
T1-T2	none

5. Given the search tree below, find a solution using backtracking (without forward checking). (Note that we're assuming variable assignment order of T1, T2, T3, T4, and value assignment order of L1, L2, L3.) Show assignments of values to variables in order by labeling arcs on the graph in consecutive order. (Assume assignments are made, then checked for validity.)

How many assignments were made?

What is the solution?



6. Now find a solution using backtracking with forward checking. Label the tree as in the previous question, showing assignments of values in order. Also show which branches are pruned by forward checking. (Draw a line across the arc with the disallowed value.)

How many assignments were made?

What is the solution?

